WHAT IS CLAIMED IS:

1. An automotive lane deviation prevention (LDP) apparatus comprising:

a processor programmed to perform the following,

(a) detecting a lane marking line on a driving lane of a host vehicle, based on a picture image in front of the host vehicle;

(b) determining, based on a detection result regarding the lane marking line, whether the host vehicle is in a first state where there is an increased tendency for the host vehicle to deviate from the driving lane or in a second state where there is a less tendency for the host vehicle to deviate from the driving lane;

(c) executing LDP control by which the host vehicle's lane deviation tendency is avoided, when the host vehicle is in the first state;

(d) determining whether the host vehicle is in a third state where the host vehicle is traveling on predetermined irregularities formed on or close to the lane marking line, in a lane-marking non-detecting state where the lane marking line is out of an image pick-up enabling area; and

(e) executing, based on a detection result regarding whether the host vehicle is in the third state and the detection result regarding the lane marking line, vehicle yawing motion control by which the host vehicle returns to a central position of the driving lane, in the lane-marking non-detecting state.

2. An automotive lane deviation prevention (LDP) apparatus comprising:

a lane marking detector that detects a lane marking line on a driving lane of a host vehicle, based on a picture image in front of the host vehicle;

an actuator capable of variably adjusting a yawing motion of the host vehicle;

a control unit configured to be electronically connected to the lane marking detector and the actuator for vehicle yawing motion control and LDP control purposes; the control unit comprising:

(a) a lane-deviation tendency detection section that determines, based on a detection result regarding the lane marking line, whether the host vehicle is in a first state where there is an increased tendency for the host vehicle to deviate from the driving lane or in a second state where there is a less tendency for the host vehicle to deviate from the driving lane;

(b) an LDP control section that executes the LDP control by which the host vehicle's lane deviation tendency is avoided, when the host vehicle is in the first state;

(c) a road-surface irregularities detection section (S4-S5) that determines whether the host vehicle is in a third state where the host vehicle is traveling on predetermined irregularities formed on or close to the lane marking line; and

(d) a vehicle yawing motion control section that executes, based on a detection result of the road-surface irregularities detection section and the detection result of the lane-deviation tendency detection section, vehicle yawing motion control by which the host vehicle returns to a central position of the driving lane, in a lane-marking non-detecting state where the lane marking line is out of an image pick-up enabling area.

3. The automotive lane deviation prevention apparatus as claimed in claim 2, wherein:

the vehicle yawing motion control section maintains a controlled variable of the LDP control at a previous value for a predetermined time period, when the host vehicle is conditioned in the first and third states in presence of a transition from a lane-marking detecting state where the lane marking line is within the image pick-up enabling area to the lane-marking non-detecting state.

4. The automotive lane deviation prevention apparatus as claimed in claim 2, wherein:

the vehicle yawing motion control section initiates the vehicle yawing motion control by which the host vehicle returns to the central position of the driving lane, when the host vehicle is conditioned in the second and third states in presence of a transition from a lane-marking detecting state where the lane marking line is within the image pick-up enabling area to the lane-marking non-detecting state.

5. The automotive lane deviation prevention apparatus as claimed in claim 4, wherein:

the control unit further comprises a lane-deviation tendency estimation section that estimates, based on the lane marking line detected by the lane marking detector before the transition from the lane-marking detecting state to the lane-marking non-detecting state, whether the host vehicle is in a fourth state where there is an increased tendency for the host vehicle to deviate from the driving lane or in a fifth state where there is a less tendency for the host vehicle to deviate from the driving lane; and

the vehicle yawing motion control section initiates the vehicle yawing motion control by which the host vehicle returns to the central position of the driving lane, when

the host vehicle is conditioned in the second, third and fourth states in presence of the transition from the lane-marking detecting state to the lane-marking non-detecting state.

6. The automotive lane deviation prevention apparatus as claimed in either one of claim 2, further comprising:

wheel speed sensors that detect respective wheel speeds of road wheels of the host vehicle,

wherein the road-surface irregularities detection section determines that the host vehicle is in the third state, when at least one of the wheel speeds detected by the wheel speed sensors is fluctuating at a substantially constant time period determined based on a host vehicle speed.

7. The automotive lane deviation prevention apparatus as claimed in claim 6, wherein:

the road-surface irregularities detection section determines that the host vehicle is in the third state, only when either one of the left and right wheel speeds is fluctuating.

8. The automotive lane deviation prevention apparatus as claimed in claim 2, further comprising:

a vehicle-suspension up-and-down motion sensor that detects an up-and-down motion of a suspension of the host vehicle,

wherein the road-surface irregularities detection section determines, based on the suspension's up-and-down motion detected, whether the host vehicle is in the third state.

9. The automotive lane deviation prevention apparatus as claimed in either one of claim 2, wherein:

the control unit further comprises a processor programmed to perform the following,

(1) determining whether the host vehicle is traveling within an area except road-ways; and

(2) inhibiting a check for the host vehicle traveling on the predetermined irregularities, when the host vehicle is traveling within the area except road-ways.

10. The automotive lane deviation prevention apparatus as claimed in claim 2, wherein:

the control unit further comprises a traveling-path condition detector that detects a host vehicle speed, a host vehicle's yaw angle with respect to a direction of the host vehicle's driving lane, a host vehicle's lateral displacement from a central axis of the host vehicle's driving lane, and a curvature of the host vehicle's driving lane;

the lane-deviation tendency detection section calculates a future lateral-displacement estimate based on the host vehicle speed, the yaw angle, the lateral displacement, and the curvature; and

the lane-deviation tendency detection section determines that the host vehicle is in the first state, when an absolute value of the future lateral-displacement estimate is greater than or equal to a predetermined lateral-displacement criterion.

11. The automotive lane deviation prevention apparatus as claimed in claim 2, wherein:

the LDP control section controls a braking force of each of the road wheels so that a yaw moment is produced in a direction in which the host vehicle's lane-deviation tendency is avoided, when the lane-deviation tendency

detection section determines that the host vehicle is in the first state.

12. The automotive lane deviation prevention apparatus as claimed in claim 11, wherein:

the LDP control section calculates a braking/driving force controlled variable of each of the road wheels so that a yaw moment is produced in a direction in which the host vehicle's lane-deviation tendency is avoided, when the lane-deviation tendency detection section determines that the host vehicle is in the first state; and

the LDP control section controls braking/driving forces of the road wheels, responsively to the braking/driving force controlled variables calculated.

13. The automotive lane deviation prevention apparatus as claimed in claim 12, wherein:

the LDP control section calculates, based on a difference between the future lane-displacement estimate and the predetermined lane-displacement criterion, a desired yaw moment to be exerted on the host vehicle; and

the LDP control section calculates, based on the desired yaw moment, the braking/driving force controlled variable of each of the road wheels.

14. The automotive lane deviation prevention apparatus as claimed in claim 2, wherein:

the vehicle yawing motion control section produces a steering torque in a direction in which the host vehicle returns to the central position of the driving lane, when the lane-deviation tendency detection section determines that the host vehicle is in the first state.

15. An automotive lane deviation prevention (LDP) apparatus comprising:

a lane marking detection means for detecting a lane marking line on a driving lane of a host vehicle, based on a picture image in front of the host vehicle;

a yawing-motion control actuator capable of variably adjusting a yawing motion of the host vehicle;

a control unit configured to be electronically connected to the lane marking detection means and the yawing-motion control actuator for vehicle yawing motion control and LDP control purposes; the control unit comprising:

(a) lane-deviation tendency detection means for determining, based on a detection result regarding the lane marking line, whether the host vehicle is in a first state where there is an increased tendency for the host vehicle to deviate from the driving lane or in a second state where there is a less tendency for the host vehicle to deviate from the driving lane;

(b) LDP control means for executing the LDP control by which the host vehicle's lane deviation tendency is avoided, when the host vehicle is in the first state;

(c) road-surface irregularities detection means for determining whether the host vehicle is in a third state where the host vehicle is traveling on predetermined irregularities formed on or close to the lane marking line; and

(d) vehicle yawing motion control means for executing, based on a detection result of the road-surface irregularities detection means and the detection result of the lane-deviation tendency detection means, vehicle yawing motion control by which the host vehicle returns to a central position of the driving lane, in a lane-marking non-

detecting state where the lane marking line is out of an image pick-up enabling area.

16. A method of preventing lane deviation of a host vehicle employing braking force actuators that adjust braking forces applied to respective road wheels, the method comprising:

(a) detecting a lane marking line on a driving lane of a host vehicle, based on a picture image in front of the host vehicle;

(b) determining, based on a detection result regarding the lane marking line, whether the host vehicle is in a first state where there is an increased tendency for the host vehicle to deviate from the driving lane or in a second state where there is a less tendency for the host vehicle to deviate from the driving lane;

(c) executing lane deviation prevention control by feedback-controlling the braking forces applied to the road wheels so that the host vehicle's lane deviation tendency is avoided, when the host vehicle is in the first state;

(d) determining whether the host vehicle is in a third state where the host vehicle is traveling on predetermined irregularities formed on or close to the lane marking line, in a lane-marking non-detecting state where the lane marking line is out of an image pick-up enabling area; and

(e) executing, based on a detection result regarding whether the host vehicle is in the third state and the detection result regarding the lane marking line, vehicle yawing motion control by which the host vehicle returns to a central position of the driving lane, in the lane-marking non-detecting state.

17. A method of preventing lane deviation of a host vehicle employing a steering actuator that adjusts a steering torque applied to a steering wheel, the method comprising:

(a) detecting a lane marking line on a driving lane of a host vehicle, based on a picture image in front of the host vehicle;

(b) determining, based on a detection result regarding the lane marking line, whether the host vehicle is in a first state where there is an increased tendency for the host vehicle to deviate from the driving lane or in a second state where there is a less tendency for the host vehicle to deviate from the driving lane;

(c) executing lane deviation prevention control by feedback-controlling the steering torque applied to the steering wheel so that the host vehicle's lane deviation tendency is avoided, when the host vehicle is in the first state;

(d) determining whether the host vehicle is in a third state where the host vehicle is traveling on predetermined irregularities formed on or close to the lane marking line, in a lane-marking non-detecting state where the lane marking line is out of an image pick-up enabling area; and

(e) executing, based on a detection result regarding whether the host vehicle is in the third state and the detection result regarding the lane marking line, vehicle yawing motion control by which the host vehicle returns to a central position of the driving lane, in the lane-marking non-detecting state.